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Analysis of Cognitive Functions in Population Having Major Depressive Disorders

Sunidhi Sharma[1], **Sudhanshu Kacker**[1], **Neha Saboo**[1]

[1]Department of Physiology, Rajasthan University of Health Sciences, College of Medical Sciences, Jaipur, Rajasthan, India.

ABSTRACT

Background

Major Depressive Disorder (MDD) is a complex mental health disorder that has an impact on many facets of cognitive performance. MDD's cognitive symptoms might lead to overall impairments in daily functioning and quality of life. It's vital to remember that the severity and appearance of these cognitive symptoms can differ from person to person. The aim of this study is to assess the cognitive function (attention, learning, memory, decision making and executive functions) in major depressive disorder individuals.

Methods

The study was conducted in the Department of Physiology, RUHS College of Medical Sciences and associated hospitals on 90 subjects having major depressive disorder of either sex in the age group 20-40 years. Cognitive function parameters (Mini mental status examination, Montreal cognitive protocol A & B, P300 latency, and amplitude) were assessed and data were presented as mean, standard deviation (SD) and correlation coefficient was found using Pearson correlation, and p-value<0.05 considered as statistically significant.

Results

The mean score of cognitive parameters was increased which was shown as decrease in score of Montreal cognitive assessment (11.22±2.73), mini mental status examination (10.19±1.56). Delay in P300 latency (401.38±11.30) was also seen with increase in Hamilton D (18.33±6.7) score with correlation coefficient r= 0.758.

Conclusions

A strong positive correlation was observed between the Hamilton Depression (HAM-D) score and cognitive function parameter (P300), indicating that greater severity of depression is associated with a decline in cognitive performance. The relationship between depression and cognitive function is complex and varies among individuals.

Keywords: cognition; event related potentials; depressive disorder; cognitive assessment; physiological parameters.

Correspondence: Dr. Neha Saboo, Department of Physiology, Department of Physiology, Rajasthan University of Health Sciences, College of Medical Sciences, Jaipur, Rajasthan, India. Email: nehasaboo8@gmail.com, Phone: +919928053007. **Article received**: 2025-03-16. **Article accepted**: 2025-08-12. **Article published**: 2025-09-15.

INTRODUCTION

Major depressive disorder (MDD) has been ranked as the third cause of the burden of disease worldwide in 2008 by WHO, which has projected that this disease will rank first by 2030.[1] Currently, classification systems such as ICD-10 and DSM-IV are used. Depression, once primarily viewed as an emotional disorder, is now recognized to also have a cognitive component. Among the key symptoms of MDD are difficulties with focus and concentration, and it is well established that individuals with severe depression may experience significant cognitive impairment.[2-4] According to National mental health survey of India estimated prevalence of lifetime and present depressive disorder was 5.25% and 2.68%[5]. Longitudinal investigations have revealed that poor focus, poor memory, and trouble making judgments are prevalent symptoms of MDD.[6] Therefore, the present study was conducted to evaluate cognitive functions in individuals diagnosed with major depressive disorder.

METHODS

This study took place from July 2022 to January 2023 at the Department of Physiology and Medicine, Rajasthan University of Health Sciences College of Medical Sciences and affiliated Hospitals in Jaipur, Rajasthan. The ethical clearance was obtained from institutional ethics committee (IEC) of RUHS College of Medical Sciences (RUHS-CMS/Ethics/Comm./2022-23/64). The patients came from and around Jaipur, and they were from both urban and rural areas, as well as from different socioeconomic backgrounds. The purpose of the research was explained to the participants, and written informed consent was obtained using a specified proforma. The calculated sample size for the study was 77 with confidence level of 95%. Considering a 10% dropout rate, the final sample size was 90. Participants aged 20–40 years with Major Depressive Disorder, diagnosed per ICD-10 criteria (symptoms lasting >2 weeks such as low mood, anhedonia, weight/appetite changes, poor concentration, guilt, fatigue, or suicidal thoughts), who provided written informed consent, were included. Persons aged between 20 -40, subjects having psychotic illness like schizophrenia or schizoaffective disorder, bipolar disorder, organic disorders such as dementia, epilepsy or cerebrovascular disease, electroconvulsive therapy (last 3 months), musculoskeleton disorders like, kyphosis, scoliosis, chronic diseases like hypertension, diabetes and chronic renal disease were excluded from the study. All depressive population was assessed on the basis of Hamilton rating scale for depression.[7] A detailed clinical history, sociodemographic profile,[8] anthropometric parameters[9] (height, weight, BMI, waist and hip circumference), blood pressure[10] and cognitive function parameters (Mini-mental state examination, Montreal cognitive protocol A & B[11-12] and auditory Event Related Potential (P300) involving standard auditory oddball paradigm on Octopus NCV/EMG/EP-4 Ch. Machine (Model-CMEMG 01) were recorded. The study comprised participants who met the inclusion and exclusion criteria. A detailed proforma was used to collect clinical history and sociodemographic information. Following recruitment from the psychiatry department, the Hamilton Depression Rating Scale (HAM-D) was used to evaluate the severity of depression, and P300 was performed on every participant.

The entire test procedure was carried out in the neurophysiology lab's silent acoustic room. Subjects were instructed to sit comfortably and not to sleep during the testing session. Two active electrodes were put to each mastoid process (A1 and A2), a ground electrode was placed on the Fpz position, and a reference electrode was placed on the Cz position of the scalp. In order to hear both common and uncommon tones with different loudness or pitch, subjects were also instructed to don headphones. Additionally, each time they heard the rarer tone, the subjects were instructed to identify it and raise their dominant hand. They were advised to close their eyes and data was collected. Data were entered in Microsoft Excel and analyzed with SPSS-16. Statistical significance was determined at p-value< 0.05. The data were presented in form of mean and standard deviation,

and the correlation coefficient (r) determined using Pearson correlation.

RESULTS

Table 1 depicts the distribution of participants according to anthropometric parameters which include age (years) and body mass index (Kg/m^2), physiological parameters which includes systolic blood pressure (mmHg) and diastolic blood pressure (mmHg), and Hamilton rating scale for assessment of depression.

Table 1. Distribution of anthropometric and physiological parameters. (n=90)

Parameters	Mean ± SD
Age (Years)	29.3±10.1
BMI (Kg/m^2)	29.3±4.5
SBP (mmHg)	148±5.6
DBP (mmHg)	81.77±10.41
HAM D	18.33±6.7

Note: BMI =Body Mass Index, SBP= Systolic Blood Pressure, DBP= Diastolic Blood Pressure, HAMD= Hamilton rating scale for depression.

Table 2 depicts the distribution of participants according to cognitive function parameters which includes Montreal cognitive assessment A& B, Mini mental state examination, P300 latency (milliseconds) and amplitude (microvolt).

Table 2. Distribution of cognitive function parameters. (n=90)

Parameters	Mean ± SD
MoCA & B	11.22±2.73
MMSE	10.19±1.56
P300 Latency (ms)	401.38±11.3
P300 Amplitude (µV)	6.76±2.07

Note: MoCA& B = Montreal cognitive assessment A& B, MMSE = Mini mental status examination.

Table 3. Pearson correlation of HAM D with various cognitive parameters. (n=90)

Parameters	HAM D	
	r-value	p-value
MoCA & B	0.112	0.293
MMSE	-0.005	0.962
P300 Latency	0.758	<0.0001
P300 Amplitude	-0.172	0.105

Note: HAM D= Hamilton rating scale for depression, MoCA& B= Montreal cognitive assessment A& B, MMSE= Mini mental status examination.

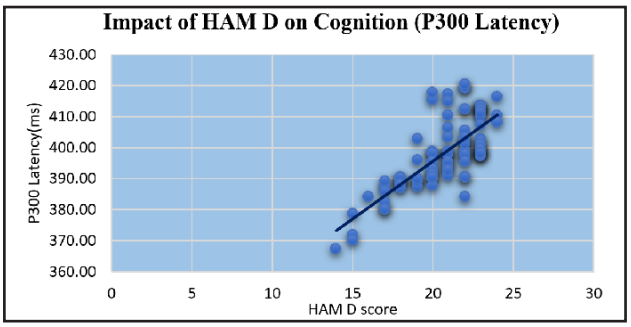

Figure 1. Impact of major depressive disorder on P300 Latency.

DISCUSSION

The study was conducted with the objective to correlate the Cognitive functions among Major depressive Disorder population. In this study, Table 1 shows a significant increase in BMI, systolic BP, and diastolic BP, consistent with findings by Luo G et al.,[13]Table 2 demonstrates a significant decrease in MMSE and MoCA scores, along with increased P300 amplitude and altered P300 latency in MDD subjects. These results are in agreement with Himani et al.[14] and Tripathi et al.[15] but differ from Kaustio et al., who reported no significant differences in P300 measures between depressed and control groups, although they noted an association between psychotic symptoms and prolonged P300 latency.[16]

Table 3 depicts the correlation coefficient in between HAM D score and cognitive function parameters which suggest that it might be one of the areas where researchers look at the usage of P300 in depression so that its significance as a prognostic biomarker for depression can be established. Since the cognitive function parameters in MDD subjects are altered, it is widely assumed that variations in the P300's amplitude are related to changes in intensity, energy required, or degree of arousal associated with a particular task[17]. This suggests that cognitive dysfunctions are one of the factors that are linked to depressive symptoms.

Depressed people have low concentration, which leads in delayed processing time, which is seen as delayed P300 latency. Figure 1 represents a scatter plot of the correlation of HAM D score with P300 latency, which indicates a positive correlation between these two parameters, implying that as HAM D score increases, so does P300 delay. One study showed a positive association between P300 and HAM D score[18], owing to fact that hypothalamic-pituitary-adrenal (HPA) axis, which regulates the body's stress response, is frequently dysregulated in depression. Elevated cortisol levels, which are associated with chronic stress, may have a deleterious influence on cognitive function, particularly memory and attention, as evidenced by the considerable rise in cognitive parameters seen in this study.[19]

CONCLUSIONS

The present study concluded that there was a strong positive correlation between Hamilton rating score for depression and P300 latency. This indicates that major depressive disorder leads to a decline in cognitive functions, highlighting the need to raise public awareness about its impact across both younger and older age groups. It is important to perform additional study while taking lifestyle adjustments into account.

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